

SEP 06 2005

Serial No. 10/607,283
60246-211; 10645

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant: Chen
Serial No.: 10/607,283
Filed: June 26, 2003
Group Art Unit: 3744
Examiner: Norman, Marc E.
Title: CONTROL OF REFRIGERATION SYSTEM TO OPTIMIZE
COEFFICIENT OF PERFORMANCE

Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

Subsequent to the filing of the Notice of Appeal on June 30, 2005 and received by the United States Patent and Trademark Office on July 5, 2005, Appellant hereby submits its brief. The Commissioner is authorized to charge Deposit Account No. 03-0835, in the name of Carrier Corporation, \$500.00 for the appeal brief fee. If any additional fees are due, the Commissioner is authorized to charge Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds, P.C. for any additional fees or credit the account for any overpayment.

REAL PARTY IN INTEREST

The real party in interest is Carrier Corporation, the assignee of the entire right and interest in this Application.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

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Claims 1-19 remain in this application. Claims 1, 2 and 14-16 are rejected under 35 USC 102(b) as being anticipated by Nishida (U.S. Patent No. 6,505,76), claim 7 is allowed, and claims 3-6 and 8-13, which depend on claim 1, have been withdrawn from consideration. Claims 17-19 were added by amendment on January 25, 2005. However, the Examiner has not commented on these claims in the Final Rejection.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF THE INVENTION

As shown in Figure 1, this invention relates to a method of optimizing a coefficient of performance of a refrigeration system 20 including the steps of compressing a refrigerant to a high pressure in a compressor device 22, cooling the refrigerant in a heat rejecting heat exchanger 24 (paragraph 24), expanding the refrigerant to a low pressure in an expansion device 26 (paragraph 15), and evaporating the refrigerant in a heat accepting heat exchanger 28 (paragraph 16). The method further includes the steps of sensing a parameter of the refrigeration system 20, comparing the parameter to an efficiency parameter representative of an efficient refrigeration system, determining a state of efficiency of the refrigeration system 20 based on the step of comparing (paragraph 21) and adjusting the refrigeration system 20 if the step of determining the state of efficiency determines that the refrigeration system 20 is operating at an inefficient state to optimize the coefficient of performance (paragraph 33). These features are set forth in independent claim 1.

Claim 14 depends on claim 1 and adds that the step of adjusting the refrigeration system 20 includes increasing a flow rate of a fluid flowing through the heat rejecting heat exchanger 24 that exchanges heat with the refrigerant (paragraph 34). Claim 15 depends on claim 1 and adds that the step of adjusting the refrigeration system 20 includes increasing a size of an opening of the

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expansion device 26 (paragraph 35). Claim 18 depends on claim 1 and adds that water exchanges heat with said refrigerant in said heat rejecting heat exchanger 24 (paragraph 24).

Independent claim 16 recites a transcritical refrigeration system 20 including a compression device 22 to compress a refrigerant to a high pressure, a heat rejecting heat exchanger 24 for cooling the refrigerant (paragraph 14), an expansion device 26 for reducing the refrigerant to a low pressure (paragraph 15) and a heat accepting heat exchanger 28 for evaporating the refrigerant (paragraph 16). The system 20 also includes a sensor 70, 76, 78, 80, 82, 84, 86, 88, 90, 92 and 94 to sense a parameter of the refrigerant system 20 and a control 72 that stores an efficiency value of the parameter representative of an efficient state of the refrigeration system 20, compares the efficiency value to the parameter to determine a state of efficiency of the refrigeration system 20 (paragraph 21) and adjusts the refrigeration system 20 if the refrigeration system 20 is determined to be operating in an inefficient state to optimize a coefficient of performance of the refrigeration system 20 (paragraph 33).

Claim 17 depends on claim 16 and adds that the parameter is a temperature difference between a refrigerant temperature of the refrigerant exiting the heat rejecting heat exchanger 24 and a fluid temperature of a fluid entering the heat rejecting heat exchanger 24 that exchanges heat with the refrigerant in the heat rejecting heat exchanger 24 (paragraph 26). Claim 19 depends on claim 16 and adds that water exchanges heat with the refrigerant in the heat rejecting heat exchanger 24 (paragraph 14).

ISSUES

- A. Are Claims 1, 2 and 15-16 properly rejected under 35 U.S.C. 102(c) as being anticipated by Nishida (U.S. Patent No. 6,505,476)?
- B. Is Claim 14 properly rejected under 35 U.S.C. 102(e) as being anticipated by Nishida?
- C. Is Claim 17 properly rejected under 35 U.S.C. 102(e) as being anticipated by Nishida?
- D. Are Claims 18-19 properly rejected under 35 U.S.C. 102(c) as being anticipated by Nishida?

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PATENTABILITY ARGUMENTS

A. The rejection of Claims 1, 2 and 15-16 under 35 U.S.C. 103(a) is improper.

The Examiner finally rejected Claims 1, 2 and 15-16 as being anticipated by Nishida. The Examiner contends that Nishida discloses a method of optimizing a coefficient of performance of a refrigeration system including a compressor 100, a heat rejecting heat exchanger 200, an expansion valve 300 and an evaporator 400 including the steps of sensing a parameter (step 660), comparing the parameter to an efficiency parameter (step 670), determining a state of efficiency of the system (step 680) and adjusting the refrigeration system (step 690), and therefore the claimed invention is anticipated. Appellant respectfully disagrees.

The present invention is patentable and strikingly different from Nishida. As described by the claims, the present invention provides a method and apparatus for optimizing a coefficient of performance of a refrigeration system including the steps of sensing a parameter of the refrigeration system, comparing the parameter to an efficiency parameter representative of an efficient refrigeration system, determining a state of efficiency of the refrigeration system based on the step of comparing and adjusting the refrigeration system if the step of determining the state of efficiency determines that the refrigeration system is operating at an inefficient state to optimize the coefficient of performance. See Claim 1. Claims 1-19 of the present invention all share this same or similar feature. [See Claims 1-19].

Nishida does not disclose the claimed invention. Nishida does not disclose a method of optimizing a coefficient of performance of a refrigeration system including the step of comparing a sensed parameter to an efficiency parameter representative of an efficient refrigeration system. Nishida discloses comparing an air temperature T_r of air blown from a radiator 200 to a target temperature T_t at step 670. The target temperature T_t is calculated based on a temperature T_s set by a temperature setting unit 660 and an inlet air temperature T_i of air flowing into the radiator 200 as detected by an inlet air temperature sensor 640 (column 11, lines 23-29). When the air temperature T_r blown from the radiator 200 equals the target temperature T_t , the coefficient of performance is calculated at step 680. The target temperature T_t is not a temperature that represents an efficient

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refrigeration system, but instead represents a temperature at which the effective efficiency is to be calculated. Next, at the step 690, the speed of a compressor 100 and an opening degree of a pressure control valve 300 are changed to determine an effective efficiency η . That is, once the air temperature T_t equals the target temperature T_t , the effective efficiency is calculated. The target temperature T_t represents a desired temperature of the air exiting or blown from the radiator 200 and does not represent a parameter representative of an efficient refrigeration system.

After the effective efficiency η is calculated, the compressor speed R and the opening degree of the expansion valve 300 are increased at step 690, and the effective efficiency η is calculated again at step 700. This is repeated until the effective efficiency η is less than the previously calculated effective efficiency η_{n-1} at step 710. Once this occurs, the compressor speed R of the compressor 100 and the opening degree of the expansion valve 300 are decreased at step 720, and the effective efficiency η is calculated again at step 740. This is repeated until a comparison indicates that the effective efficiency η is less than the previously calculated effective efficiency η_{n-1} at step 740. Once this occurs, the target temperature T_t is calculated at step 750, and the air temperature T_r is detected at step 760. When the target temperature T_t does not equal the air temperature T_r at step 770, the high side pressure P_h and the compressor speed R are controlled until the air temperature T_r equals the target temperature T_t at step 830. Once this occurs, the process repeats at step 680.

The target temperature T_t does not represent an efficient system. If the target temperature T_t represented an efficient system, it would not be necessary to perform the later steps of adjusting the speed of the compressor 100 and the opening degree of the expansion valve 300 in steps 690 and 720 to determine the effect on the effective efficiency η before the target temperature T_t is recalculated at step 750. The target temperature T_t does not represent an efficient system, but only represents a value that triggers the calculation of an effective efficiency at step 680 and the testing of the effective efficiency in steps 700 and 730. Nishida does not disclose that the target temperature T_t is representative of an efficient system as claimed, and therefore Nishida does not disclose comparing a parameter of a refrigeration system to an efficiency parameter representative of an efficiency

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refrigeration system. The claimed invention is not anticipated, and Appellant respectfully requests that the rejection be withdrawn.

B. The rejection of Claims 14 under 35 U.S.C. 102(e) is improper.

Claim 14 stands finally rejected as being anticipated by Nishida. Claim 14 recites that the step of adjusting the refrigeration system includes increasing a flow rate of a fluid flowing through the heat rejecting heat exchanger that exchanges heat with the refrigerant. Nishida does not disclose this feature. Nishida discloses adjusting a refrigeration system by controlling the opening degrees of a pressure control valve 300 and the rotational speed of the compressor 100 (column 12, lines 11-40). However, Nishida does not disclose increasing the flow rate of the air that flows through the radiator 200 as claimed. The claimed invention is not anticipated, and Appellant respectfully requests that the rejection be withdrawn.

C. The rejection of Claims 17 under 35 U.S.C. 102(e) is improper.

The Examiner did not provide any comments about claim 17. Claim 17 recites that the parameter is a temperature difference between a refrigerant temperature of the refrigerant exiting the heat rejecting heat exchanger and a fluid temperature of a fluid entering the heat rejecting heat exchanger that exchanges heat with the refrigerant in the heat rejecting heat exchanger. Nishida does not disclose any comparison of a refrigerant temperature to a fluid temperature. This feature is also cited in claim 7, which has been allowed. Nishida does not disclose this feature.

D. The rejection of Claims 18 and 19 under 35 U.S.C. 102(e) is improper.

The Examiner did not provide any comments about Claims 18 and 19. Claims 18 and 19 are not anticipated by Nishida. Claims 18 and 19 recite that water exchanges heat with the refrigerant in the heat rejecting heat exchanger. Nishida discloses that refrigerant discharged from a compressor 100 flows into a radiator 200. Air passing through the radiator 200 is heated by exchanging heat between air inside a compartment and refrigerant flowing through the radiator 200. Nishida

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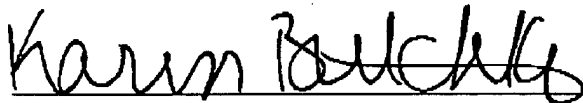
discloses that air exchanges heat with the refrigerant in the radiator 200. The refrigerant does not exchange heat with water in the radiator 200 as in the claimed invention. The claimed invention is not anticipated, and Appellant requests that the rejection be withdrawn.

CLOSING

For the reasons set forth above, the rejection of all claims is improper and should be reversed. Appellant respectfully requests such an action.

Respectfully Submitted,

CARLSON, GASKEY & OLDS, P.C.

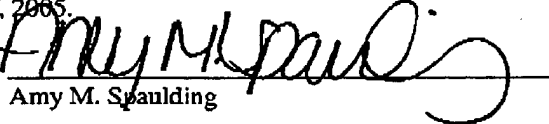


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Dated: September 6, 2005

CERTIFICATE OF FACSIMILE

I hereby certify that this appeal brief is being facsimile transmitted to the United States Patent and Trademark Office, 571-273-8300 on September 6, 2005.



Amy M. Spaulding

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CLAIM APPENDIX

1. A method of optimizing a coefficient of performance of a refrigeration system comprising the steps of:
 - compressing a refrigerant to a high pressure in a compressor device;
 - cooling said refrigerant in a heat rejecting heat exchanger;
 - expanding said refrigerant to a low pressure in an expansion device;
 - evaporating said refrigerant in a heat accepting heat exchanger;
 - sensing a parameter of said refrigeration system;
 - comparing said parameter to an efficiency parameter representative of an efficient refrigeration system;
 - determining a state of efficiency of the refrigeration system based on the step of comparing; and
 - adjusting said refrigeration system if the step of determining said state of efficiency determines that the refrigeration system is operating at an inefficient state to optimize the coefficient of performance.
2. The method as recited in claim 1 wherein said refrigerant is carbon dioxide.
3. The method as recited in claim 1 wherein said parameter is an outlet temperature of said refrigerant exiting said heat rejecting heat exchanger.
4. The method as recited in claim 1 wherein said parameter is an outlet enthalpy of said refrigerant exiting said heat rejecting heat exchanger.
5. The method as recited in claim 1 wherein said parameter is a pressure difference between a first pressure of said refrigerant entering said heat rejecting heat exchanger and a second pressure of said refrigerant exiting said heat rejecting heat exchanger.

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6. The method as recited in claim 1 wherein said parameter is a flow rate of a fluid that exchanges heat with said refrigerant in said heat rejecting heat exchanger.

7. A method of optimizing a coefficient of performance of a refrigeration system comprising the steps of:

compressing a refrigerant to a high pressure in a compressor device;

cooling said refrigerant in a heat rejecting heat exchanger;

expanding said refrigerant to a low pressure in an expansion device;

evaporating said refrigerant in a heat accepting heat exchanger;

sensing a parameter of said refrigeration system, wherein said parameter is a temperature difference between a refrigerant temperature of said refrigerant exiting said heat rejecting heat exchanger and a fluid temperature of a fluid entering said heat rejecting heat exchanger that exchanges heat with said refrigerant in said heat rejecting heat exchanger;

comparing said parameter to an efficiency parameter representative of an efficient refrigeration system;

determining a state of efficiency of the refrigeration system; and

adjusting said refrigeration system if the step of determining said state of efficiency determines that the refrigeration system is operating at an inefficient state.

8. The method as recited in claim 1 wherein said parameter is a suction pressure of said refrigerant entering said compressor device.

9. The method as recited in claim 1 wherein said parameter is a temperature of said refrigerant exiting said compressor device.

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10. The method as recited in claim 1 wherein said parameter is a size of an opening of said expansion device.

11. The method as recited in claim 1 wherein said parameter is a quality of said refrigerant entering said heat accepting heat exchanger.

12. The method as recited in claim 1 wherein said parameter is a coefficient of performance of the refrigeration system

13. The method as recited in claim 1 wherein said parameter is a refrigerant mass flow rate of the refrigeration system.

14. The method as recited in claim 1 wherein the step of adjusting said refrigeration system includes increasing a flow rate of a fluid flowing through said heat rejecting heat exchanger that exchanges heat with said refrigerant.

15. The method as recited in claim 1 wherein the step of adjusting said refrigeration system includes increasing a size of an opening of said expansion device.

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16. A transcritical refrigeration system comprising:
a compression device to compress a refrigerant to a high pressure;
a heat rejecting heat exchanger for cooling said refrigerant;
an expansion device for reducing said refrigerant to a low pressure;
a heat accepting heat exchanger for evaporating said refrigerant;
a sensor to sense a parameter of the refrigerant system; and
a control that stores an efficiency value of said parameter representative of an efficient state of the refrigeration system, compares said efficiency value to said parameter to determine a state of efficiency the refrigeration system, and adjusts the refrigeration system if the refrigeration system is determined to be operating in an inefficient state to optimize a coefficient of performance of the system.

17. The system as recited in claim 16 wherein said parameter is a temperature difference between a refrigerant temperature of said refrigerant exiting said heat rejecting heat exchanger and a fluid temperature of a fluid entering said heat rejecting heat exchanger that exchanges heat with said refrigerant in said heat rejecting heat exchanger.

18. The method as recited in claim 1 wherein a fluid exchanges heat with said refrigerant in said heat rejecting heat exchanger, and said fluid is water.

19. The system as recited in claim 16 wherein a fluid exchanges heat with said refrigerant in said heat rejecting heat exchanger, and said fluid is water.